

Remarks

A. Pending Claims

Claims 14-19, 22-30, and 32-36 are pending. Claim 35 has been amended. Claims 14-19, 22-30, and 32-36 have been rejected.

B. The Claims Are Patentable Over Nishibayashi In View Of Klett

The Examiner rejected claims 14, 19, 22-24, 32, 35, and 36 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,171,691 to Nishibayashi (hereinafter “Nishibayashi”) in view of “Carbon Foam for Electronics Cooling” *Automotive Propulsion Materials, 2001 Annual Report*, pages 19-25, by Klett et al. (hereinafter “Klett”). Applicant respectfully disagrees that the claims are unpatentable over the cited art.

To reject a claim as obvious, the Examiner has the burden of establishing a *prima facie* case of obviousness. *In re Warner et al.*, 379 F.2d 1011 (C.C.P.A. 1967). To establish a *prima facie* case of obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 U.S.P.Q. 580 (C.C.P.A. 1974); MPEP 2143.03.

The Examiner states:

Referring to Figs. 1-19 and related text, Nishibayashi discloses [Claims 14 and 32] a method of coupling a carbon material to an integrated circuit comprising: coating a carbon material with first solder 2...But Nishibayashi does not disclose expressly the use of carbon foam. However, the missing limitation is well known in the art because Klett discloses this feature...A person of ordinary skill is motivated to modify Nishibayashi with Klett to obtain device using good thermal conductive heat sink at a lower price. (Office Action, page 2).

Claim 14 includes a combination of features including, but not limited to, the features of “coating a carbon foam material with first solder.” Claim 32 includes a combination of features

including, but not limited to, the features of “applying a solder to a surface of a carbon foam material.”

Nishibayashi states “the heat sink material for use with a semiconductor component according to the present invention comprises a plurality of diamond particles, a metal, and a metal carbide.” (Nishibayashi, column 2, lines 38-40). Nishibayashi appears to teach using a heat sink that includes diamonds. Nishibayashi does not appear to teach or suggest using a carbon foam material.

Combining Nishibayashi with the carbon foam of Klett would change the principle operation of Nishibayashi. If a proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teaching of the references are not sufficient to render the claims *prima facie* obvious. *In re Ratti*, 270 F.2d 810, 123 USPQ 349 (CCPA 1959), MPEP 2143.01.

Nishibayashi states “an object of the present invention is to provide a heat sink for use with a semiconductor component, having a coefficient of thermal expansion well comparable to that of a semiconductor material and yet having high thermal conductivity.” (Nishibayashi, column 2, lines 20-24). Nishibayashi also states:

when Cu is joined with a semiconductor, such as silicon (Si) having a coefficient of thermal expansion of 4.2 ppm/°C. or gallium arsenide (GaAs)...both of the joined materials suffer a large thermal stress in the cooling process from the joining temperature to room temperature, or in the cooling process from the maximum temperature achieved during the operation of the semiconductor component to room temperature. In many cases, such a large thermal stress makes the component unfeasible for use.” (Nishibayashi, column 1, lines 20-29)

Nishibayashi appears to teach selecting a heat sink with a coefficient of thermal expansion similar to a semiconductor material. Applicant submits that it would change the purpose of Nishibayashi to replace the heat sink of Nishibayashi with any conductive material that does not have a coefficient of thermal expansion that is similar to the coefficient of thermal expansion of the semiconductor material. Klett does not appear to teach or suggest forming

graphite foam with a coefficient of thermal expansion similar to a semiconductor material.

Additionally, Applicant's specification teaches:

Other criteria that may influence the selection of the solder may include the need to provide good thermal contact with minimal stress to the carbon foam or the integrated circuit. During the soldering process, stresses may develop between the integrated circuit and the carbon foam because the two materials have differing coefficients of thermal expansion. The selection of the solder may be influenced by the need to reduce these process stresses. If the process stress is too great, one or both of the components may be damaged. Additionally, fatigue resistance in the solder may be important. As the melting point of a solder is decreased, the fatigue resistance decreases.

(Specification, page 8, line 27 - page 9, line 4)

Applicant respectfully submits that combining Nishibayashi with Klett would change the principle of operation of Nishibayashi.

Furthermore, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. MPEP 2143. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 916 F.2d 680 (Fed. Cir. 1990).

Applicant also submits that Nishibayashi teaches away from using a graphite foam material, such as in Klett. Nishibayashi states:

Graphite is inferior to diamond from the viewpoint of thermal conductivity; however it sometimes functions effectively to bond the diamond particles. Moreover, the presence of graphite in small quantity is of no problem, because it does not greatly influence the thermal conductivity of the material as a whole. (Nishibayashi, column 6, lines 30-35).

Applicant submits that there is no motivation to combine Nishibayashi with Klett. Nishibayashi appears to teach away from using a large amount of graphite in a heat sink coupled to a semiconductor. Applicant respectfully submits that it would not be proper to combine the

graphite foam of Klett with Nishibayashi since Nishibayashi appears to indicate that graphite is not as desirable as the diamond based heat sink.

Applicant submits that it would be improper to combine Nishibayashi and Klett. Applicant submits that the cited art does not appear to teach or suggest all the features of independent claims 14 and 32. Applicant requests removal of the rejections to independent claims 14 and 32 and the claims dependent thereon.

The Examiner also states:

[Claim 19] Nishibayashi also discloses coating a surface of the carbon material with a second solder; [Claim 22] wherein a second solder, and wherein the second solder comprises copper, nickel, gold, silver, lead, silicon, indium, bismuth, titanium, tin, or mixtures thereof; [Claim 36] wherein the solder comprises a reactive braze alloy. (see col. 6, lines 47-62).” (Office Action, pages 2-3).

Claims 19, 22, and 36 include a combination of features including, but not limited to, the feature of “solder.” Applicant’s Specification states, “In an embodiment, the carbon foam material and the integrated circuit may be coupled using any number of solders as described herein to provide thermal contact.” (Applicant’s Specification, page 8, lines 19-20). Applicant submits that Nishibayashi does not appear to teach or suggest at least the quoted features.

Nishibayashi teaches “the heat sink material...comprises a plurality of diamond particles, a metal, and a metal carbide, wherein the metal carbide and diamond particles constitute the matrix, and the metal fills the interstices of the matrix.” (Nishibayashi, column 2, lines 38-42). Nishibayashi teaches “[b]y melting the metal 3a, the metal 3a easily penetrates the interstices of the matrix comprising the diamond particles 1 and the metal carbide 2 so as to fill the interstices.” (Nishibayashi, column 6, lines 50-53). Nishibayashi appears to teach forming a heat sink by filling spaces between diamond particles with a metal. Nishibayashi does not appear to teach or suggest the use of solder. Applicant submits that Nishibayashi does not appear to teach or suggest at least the quoted feature of the claims. Applicant respectfully requests removal of the rejections to claims 19, 22, and 36.

The Examiner states “it would have been obvious for a person of ordinary skill to either coat the second solder on the carbon material or on the integrated circuit to couple the integrated circuit and the carbon foam material since the result would be the same.” Applicant respectfully disagrees.

Claim 19 includes a combination of features including, but not limited to the feature of “coating a surface of the integrated circuit with a second solder.” Applicant respectfully submits that the Examiner’s rejection of the features of claim 19, in combination with the features of claim 14 as obvious matters of choice or design may rely upon personal knowledge of the Examiner and therefore Applicant believes MPEP 2144.03 will apply. Pursuant to MPEP 2144.03, Applicant respectfully requests the Examiner to provide support for his assertion either by an affidavit or by reference brought to the Applicant’s attention. Otherwise, Applicant requests that the rejection to claim 19 be removed.

The Examiner also states:

[Claim 35] Nishibayashi discloses a thick layer or solder that infiltrates and enveloping each particle of carbon material (see Fig. 4). In combined teaching of Nishibayashi and Klett this would correspond to a depth solder applied to the carbon foam comprising at least two carbon foam ligament diameters into a body of carbon foam material.” (Office Action, page 3).

Amended claim 35 includes a combination of features including, but not limited to, the feature of “wherein a depth of solder applied to the carbon foam comprises at least two carbon foam ligament diameters into a body of the carbon foam material.” Applicant submits that the cited art does not appear to teach or suggest at least the quoted features of the claim.

For at least the reasons previously mentioned, Nishibayashi does not appear to teach or suggest the use of a solder. Nishibayashi appears to teach the formation of a heat sink by filling spaces between diamond particles with a metal. (Nishibayashi, column 6, lines 50-53).

Furthermore, for at least the reasons previously mentioned it would not be proper to combine the

teachings of Nishibayashi with Klett. Applicant submits that the cited art does not appear to teach or suggest all the features of claim 35. Applicant respectfully requests removal of the rejection to claim 35.

C. The Claims Are Patentable Over Nishibayashi In View Of Klett And In View of Colella

The Examiner rejected claims 15-18, 27-30, and 33 under 35 U.S.C. § 103(a) as being unpatentable over Nishibayashi in view of Klett and in further view of U.S. Patent No. 5,783,316 to Colella et al. (hereinafter "Colella"). Applicant respectfully disagrees that the claims are unpatentable over the cited art.

For at least the reasons previously mentioned, Applicant submits that the features of claims 15-18 and 27-30, in combination with the features of claim 14, and the features of claim 32, in combination with the features of claim 32, are not obvious over the cited art. Applicant requests removal of the rejections to claims 15-18, 27-30, and 33.

D. The Claims Are Patentable Over Nishibayashi In View of Klett And In View Of Ohsaki

The Examiner rejected claims 25 and 26 under 35 U.S.C. § 103(a) as being unpatentable over Nishibayashi in view of Klett and in further view of U.S. Patent No. 6,198,143 to Ohsaki (hereinafter "Ohsaki"). Applicant respectfully disagrees that the claims are unpatentable over the cited art.

For at least the reasons previously mentioned, Applicant submits that the features of claims 25 and 26, in combination with the features of claim 14, are not obvious over the cited art. Applicant requests removal of the rejections to claims 25 and 26.

E. The Claims Are Patentable Over Nishibayashi In View of Klett And In View Of Colella and In View Of Kajiwara

The Examiner rejected claim 34 under 35 U.S.C. § 103(a) as being unpatentable over Nishibayashi in view of Klett and in further view of Colella and in further view of Japanese Patent No. 62-29151 to Kajiwara et al. (hereinafter "Kajiwara"). Applicant respectfully disagrees that the claims are unpatentable over the cited art.

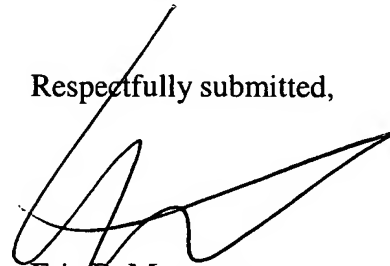
For at least the reasons previously mentioned, Applicant submits that the features of claim 34, in combination with the features of claim 32, are not obvious over the cited art. Applicant respectfully requests removal of the rejection to claim 34.

F. Additional Comments

Based on the above, Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

Applicant believes no fees are required with the filing of this response. If any extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees have been omitted or if any fees are required, please charge those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5181-83401/EBM.

Respectfully submitted,



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